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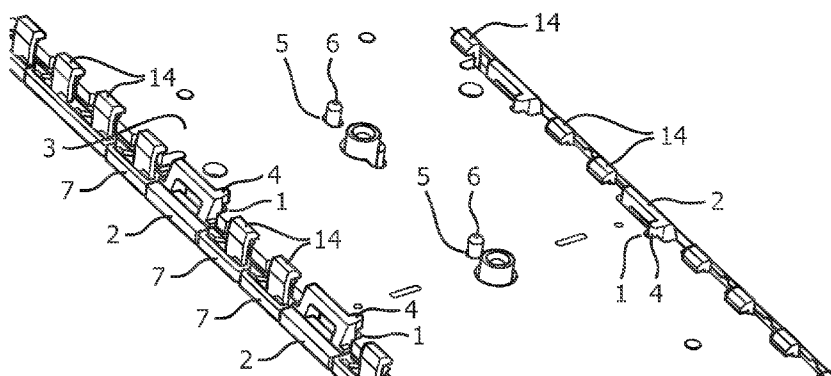
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(54) Title: MODULAR KEYBOARD ASSEMBLY



**FIG. 2B**

(57) Abstract: A key-board assembly (10) is described that has a key-mat and a keyboard PCB (3) aligned with respect to each other instead of first to a housing of an input device. First, such alignment is achieved by adding pins (6) to the key-mat that fit tightly in holes (5) of the PCB. Secondly the key-mat has hooks (14) that can be clicked around the PCB and/or ribs (4) around the edges/carve-outs of the PCB that hold to the PCB with tight tolerances.

## MODULAR KEYBOARD ASSEMBLY

## FIELD OF THE INVENTION

The invention relates to a mechanical design for a modular keyboard assembly. Such assembly typically includes 1) a key-mat with press buttons for facilitating and/or making an electrical contact on a keyboard PCB, and 2) a keyboard PCB. Such assembly is in particular useful for a keyboard in a remote control or in other portable devices having one or more keys or in a keyboard (useful e.g., for text entry).

## BACKGROUND OF THE INVENTION

The US 4 851 618 A discloses a computer keyboard in which a key holding frame is attached to a base plate comprising electrical circuits by a plurality of hooks and posts engaging with holes in the base plate.

The US 2004/031673 A1 relates to a particular design of a keypad comprising both elevated and not-elevated regions which are separately evaluated by a particular algorithm. The keypad includes a keymat that is rigidly held at its perimeter in a stretched condition across a switch substrate.

The EP 1 876 620 A1 relates to a remote control in which several components are aligned to a common housing.

Due to current product and design requirements more and more devices require input key-mat with press buttons close to each other and close to the edge of an input device.

Parts of a portable device are typically aligned to the (top and/or bottom part of) housing of the device, e.g., by hooking to the housing. This housing typically comprises a plastic injected part with higher tolerances. The key-mat and housing need to be properly aligned for visual and functional requirements and this result e.g., in gaps which are a compromise between avoiding 'sticking' key-press / buttons and small optical gaps. Also, tolerances between the press buttons are high because they are aligned towards the housing and/or the key-mat is from a rubber material with inherent high tolerances.

For a small key-mat above mentioned hooking and aligning to top and/or bottom part is feasible. However for a bigger key-mat, such as in a remote control, the hooking and aligning is less feasible, e.g., due to plastic molding tolerances. Moreover no provision for a modular design of the key-mat is available.

## SUMMARY OF THE INVENTION

There is a need to better align a key-mat to a keyboard PCB and thereby get smaller tolerances of the spacing between the press buttons.

5 It is therefore an object of the invention to provide a keyboard assembly where a key-mat and a keyboard PCB are tightly aligned with respect to each other.

This is realized according to claim 1 by providing alignment means enabling alignment of a key-mat comprising at least two key-mat strips to the PCB.

By providing alignment means, press buttons do not have to be limited in size  
10 (or can get bigger for a given size of a key board assembly) because less/no space needed between them and their surface can go all the way to the edge of the device. Robust design is provided as to prevent peeling-off of the keys (i.e. pulling out by nail or with the help of a tool). When using alignment means, tight tolerances, on parts other than the PCB, are not  
15 needed as to get even gaps between the buttons. Tight tolerances are e.g., especially challenging for standard plastic injection molded products such as typically used in handheld devices.

Another advantage of using alignment means lies in that a press button layout is less constrained by the selected tooling and (in so far applicable) related inserts, and thus allows more flexibility because it does need less optimization and dedication for specific  
20 button layouts.

Moreover using alignment means allows for a modular design by using different key-mat strips and, in so far applicable, intermediate top-parts that can be attached to the keyboard-PCB in an alternating fashion.

In the prior art the key-mat and the key-board PCB are aligned both  
25 independently to the housing of an input device. Directly aligning the key-mat and the key-board PCB with respect to each other effects that a higher accuracy is achieved.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1a Keyboard PCB showing an alignment rib position for an  
30 (intermediate) top-part.

Fig. 1b Keyboard PCB with an (intermediate) top-part attached.

Fig. 2a Keyboard PCB showing an alignment pin positions for a key-mat (strip).

Fig. 2b Keyboard PCB with an (intermediate) top-part and a key-mat (strip) attached.

Fig. 3 showing an (intermediate) top-part and a key-mat (strips) mounted on a keyboard-PCB having even gaps between the parts.

Fig. 4 Detailed drawing showing a hooking of a top-part or key-mat (strip) to a keyboard PCB and a recommended mounting position of a device housing.

Fig. 5-a~d Various possible configurations of a key-mat (strips) and combinations of key-mat strips.

## DETAILED DESCRIPTION OF EMBODIMENTS

Fig. 1a shows a keyboard PCB (3) showing alignment rib positions (1) that can be used for aligning (intermediate) top-parts to the keyboard PCB. Alignment rib positions comprise small carve outs (1) at the side of the keyboard PCB. Keyboard PCB also comprises holes (5) which can be used for aligning (intermediate) top-parts to the keyboard PCB.

Fig. 1b shows (intermediate) top-parts (2) in position with respect to the keyboard PCB whereby ribs (4) of the (intermediate) top-parts fit tightly in small carve outs (1) at the side of the keyboard PCB (3). Thereby a good alignment of the (intermediate) top-part and the key-board PCB is achieved. The alignment with the ribs can also be used with a key-mat. In this exemplary drawing the top-parts are also kept in position using alignment position pins (6) through position holes (5) in keyboard PCB (3).

Fig. 2a shows a keyboard PCB (3) showing hole positions that can be used for aligning (intermediate) top-parts (2) and key-mat strips (7) to the keyboard PCB.

Fig. 2b shows key-mat strips (7) in position with respect to the keyboard PCB (3) whereby position pins (6) of a key-mat fit tightly in (relative small) position holes (5) of the keyboard PCB. Thereby a good alignment of the key-mat strips and the key-board PCB is achieved. The alignment with the pins/holes can also be used with a (another) (intermediate) top-part.

Fig. 3 shows a top-view of a keyboard assembly (10) and in particular showing that a (tight) alignment at, e.g., position (8) has even gaps between various key-mat strips (7) and other (intermediate) top-parts (2) is achieved using the measures as shown in Figs. 1 and 2. A key-mat strip may comprise one or more pres-buttons (e.g., three keys or press buttons, 21, are shown in the bottom key-mat strips of Fig. 3) concatenated in one strip,

typically extending over the width of a portable input device. A multiple key-mat strips may be part a bigger key-mat strip, typically when positioned next to each other. However for tactile feedback to the user the key-mat strips may be not be made from one mould. Instead the key-mat strips may be connected or otherwise attached to a common (e.g., rubber) sheet positioned between the key-mat strips and the key-board PCB. An alignment pin or rib may be part of the common sheet instead or on top of the one(s) of the key-mat strip.

Fig. 4 shows a transversal cut view of a side of a portable device (20) comprising a keyboard assembly (10) and a bottom part (16). It shows a detailed mechanical drawing of the hooking between a key-mat strip (7) and the key-board PCB (3). Key-mat strip (7) comprises hook (14) that hooks at (11) to keyboard PCB (3). When a user would pull at position (13) (for example by using a finger-nail) the movement of the key-mat strip (7) will be stopped by the hook position (11). Bottom part (16) (e.g., a housing) will prevent at (12) any substantial side movement of the hook (14). Hook (14) thereby keeps in place with respect to the keyboard PCB (3) and the bottom part (16).

Fig. 5 shows various examples of possible configurations of key-mat strips (7). Key-mat strips can be combined into a unit. As can be seen from Fig. 5 it allows one or more press buttons or keys (21) to be out of a straight line.

In one embodiment the keyboard assembly (10) has alignment means that comprises at least one of:

- a first alignment pin (6) fitting in a corresponding hole (5) in a keyboard PCB (3); and
- a first alignment rib (4) locking in a corresponding carve-out (10) at a side of the keyboard PCB.

In another embodiment the keyboard assembly has a key-mat strip (7) that comprises a hook (14) for locking the key-mat strip to a bottom edge of the keyboard PCB. The hook (14) may also comprise a rib (e.g., at the bottom part of the hook) as to help locking it and prevent side movement of the hook (14).

In yet another embodiment the keyboard assembly the key-mat comprises a strip of multiple connected key-mat strips that are fully extending over at least one direction of the PCB.

In yet a further embodiment the keyboard assembly comprising at least two key-mat strips positioned either next to each other (see e.g., bottom two strips 7 in Fig. 3); or spaced using an aligned top-part (see e.g., the two strips 7 between the top-part 2 in Fig. 3).

A further embodiment has a key-mat strip that does not extend over the full width of the device (e.g., in Fig. 5). Moreover, a strip may have a complex shape including e.g., more than one row of keys and even change in number of keys and/or height within the key-mat strip (see, e.g., Fig. 5).

5 In another keyboard assembly embodiment a top-part (2) is aligned to the keyboard PCB (3) using at least one of a second alignment pin (6) fitting in a corresponding hole (5) in the keyboard PCB; and a second alignment rib (4) locking in a corresponding carve-out (1) at a side of the PCB.

10 In between various key-mat strips a (key-divide) material may be placed as to improve tactile dividing of (key-press) buttons. For instance, the user will get an improved feeling between the various buttons. This material may be a part of one of the key-mat strips or may be a separate (e.g., rubber) dividing material.

15 In one embodiment the dividing material extends in a common sheet that lies in between key-mat strips and the keyboard PCB. The key-mat strips may be attached or otherwise connected to the common sheet, effectively forming a key-mat that comprises key-mat strips and the common sheet (similar to the common sheet described earlier for Fig. 3). An alignment pin or rib may be part of the common sheet instead or on top of the one(s) of the key-mat strip.

20 The keyboard assembly according one of the previous embodiments can be made by using a key-mat that comprises a plastic or a rubber molded part.

The keyboard assembly embodiments may have a PCB that comprises a carbon or other contact area for making an electrical contact when the key-part is actuated.

25 The invention works with several types of keys to be actuated by a user. For instance the keyboard assembly may have a PCB that comprises a metal dome key that can be actuated by the key-part.

In another embodiment, the keyboard PCB may be replaced by a flexible foil in combination with contact areas that allows different shapes of a handheld device in combination with a part that has tight tolerances and that takes over the function of the keyboard PCB.

30 The above embodiments can be used in combination with existing button technologies and solutions.

The previously described embodiments of the keyboard assembly are in particular useful for in a handheld device such as a remote control, a PDA, a cellular telephone.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. The word 'comprising' does not exclude the presence of other elements or steps than those listed, and the word 'a' or 'an' preceding an element does not exclude the presence of a plurality of such elements. Any reference signs do not limit the scope of the claims.

For instance, the invention may be implemented for key-mats for use with both with hard and soft key press buttons and corresponding materials. Materials that can be used to make the key-mat include rubber, plastic and metal in combination with all types of finishing and printing and colors (including colorless). The key-mats may also include a backlighting (e.g., by means of LEDs on the keyboard-PCB and by using an at least partly translucent key-mat) or may comprise themselves a light-source. The key-mats may also be combined with (proximity) sensing that may, e.g., be used for improved user feedback.

## CLAIMS:

1. A keyboard assembly (10) comprising :

- a key-mat comprising at least two separate key-mat strips (7); and
- a keyboard PCB (3);

characterized in that the key-mat strips comprise alignment means (4, 6) to align with the  
5 keyboard PCB (3).

2. The keyboard assembly of claim 1 wherein the alignment means comprises at least one of:

- a first alignment pin (6) fitting in a corresponding hole (5) in the keyboard

10 PCB (3); and

- a first alignment rib (4) locking in a corresponding carve-out (1) at a side of the keyboard PCB (3).

3. The keyboard assembly (10) according one of the previous claims wherein at  
15 least one of the key-mat strips comprises a hook (14) for locking the key-mat strip to a bottom edge of the keyboard PCB.

4. The keyboard assembly (10) according one of the previous claims wherein the key-mat comprises a multiple, connected, key-mat strip that is fully extending over at least  
20 one direction of the keyboard PCB.

5. The keyboard assembly (10) according one of the previous claims comprising at least two key-mat strips (7) positioned either

- next to each other; or
- 25 - spaced using an aligned top-part (2).

6. The keyboard assembly according to claim 5 wherein a multiple of key-mat strips are combined into a unit having three or more press buttons (21) not positioned in a straight line.



7. The keyboard assembly according to claim 5 wherein the intermediate top-part (2) is aligned to the keyboard PCB using at least one of

- a second alignment pin (6) fitting in a corresponding hole (5) in the keyboard

5 PCB (3); and

- a second alignment rib (4) locking in a corresponding carve-out (1) at a side of the keyboard PCB (3).

8. The keyboard assembly (10) according one of the previous claims wherein the  
10 key-mats comprise a plastic or a rubber molded part.

9. The keyboard assembly (10) according one of the previous claims wherein the keyboard PCB (3) comprises a carbon area for making an electrical contact when a press-button (21) is actuated.

15

10. The keyboard assembly according one of the previous claims wherein the keyboard PCB comprises a metal dome key that can be actuated when a press-button (21) is actuated.

20 11. A handheld device comprising the keyboard assembly (10) according one of the previous claims.

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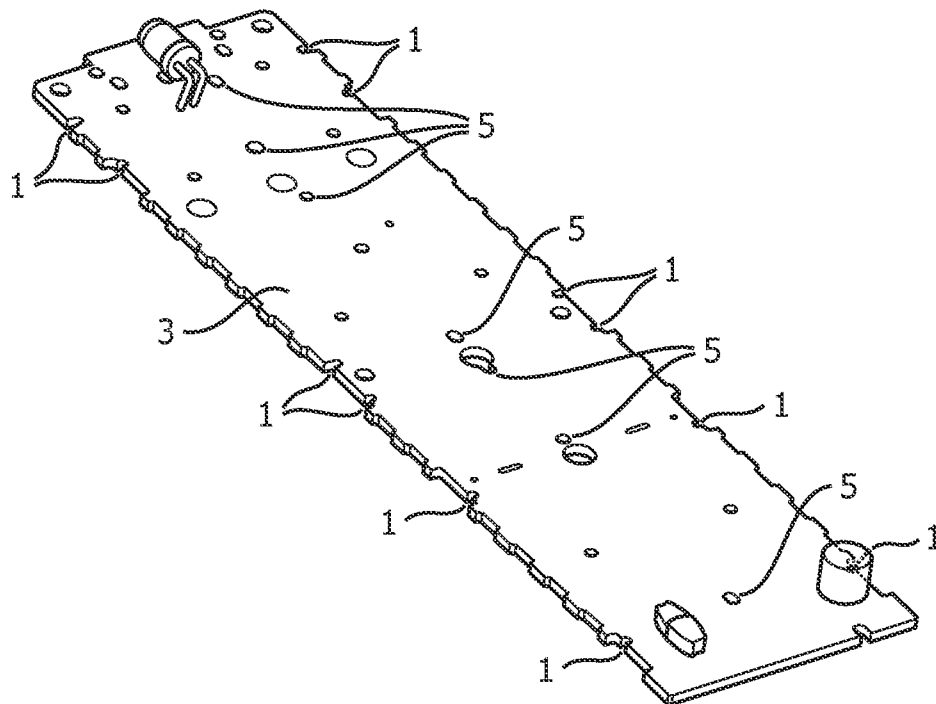


FIG. 1A

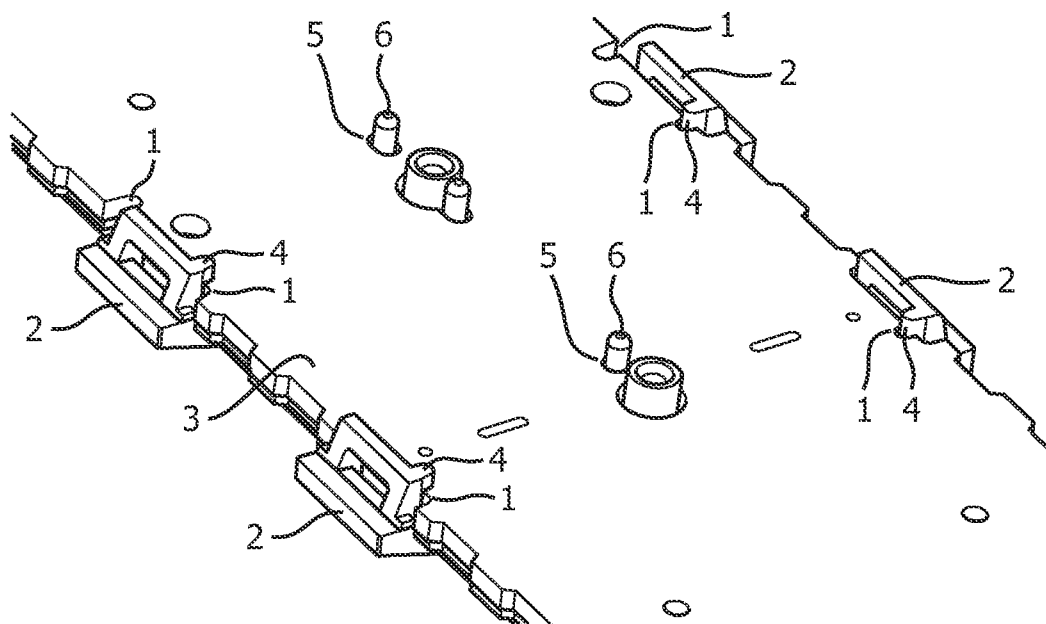


FIG. 1B

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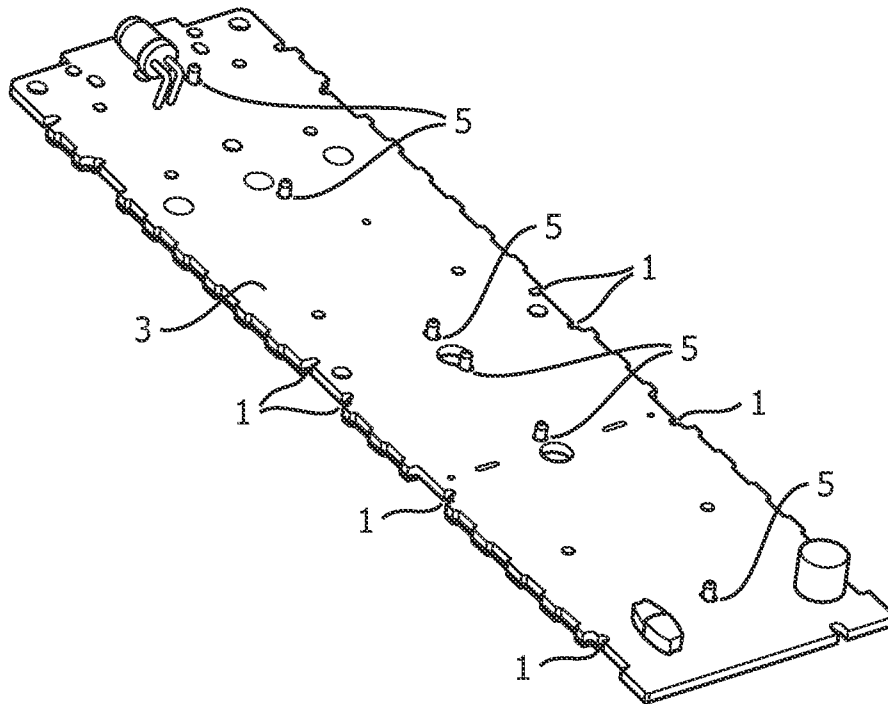


FIG. 2A

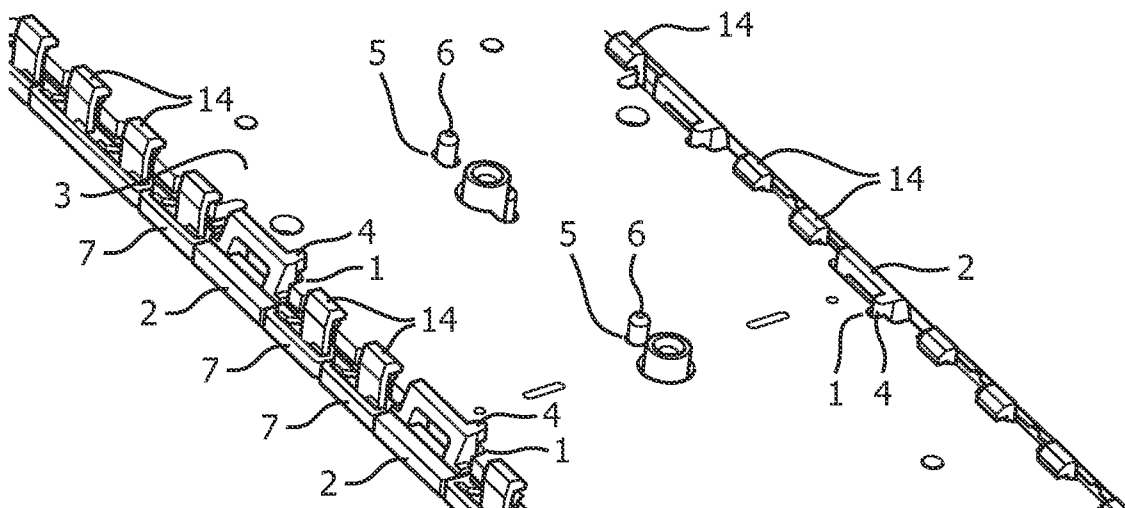


FIG. 2B

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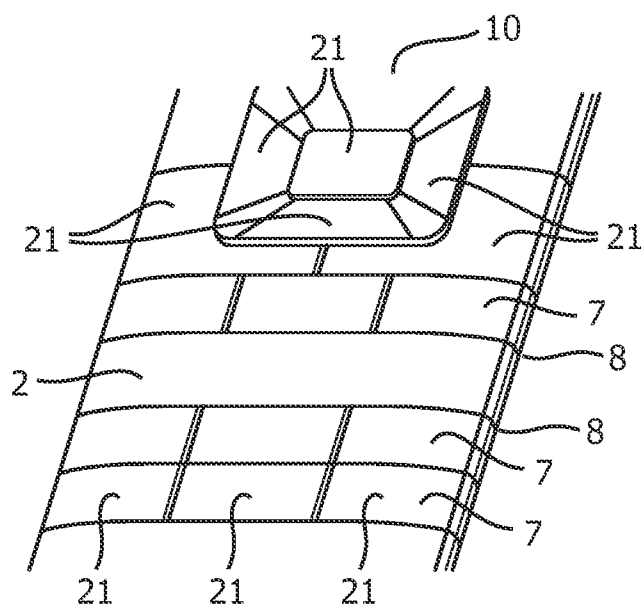


FIG. 3

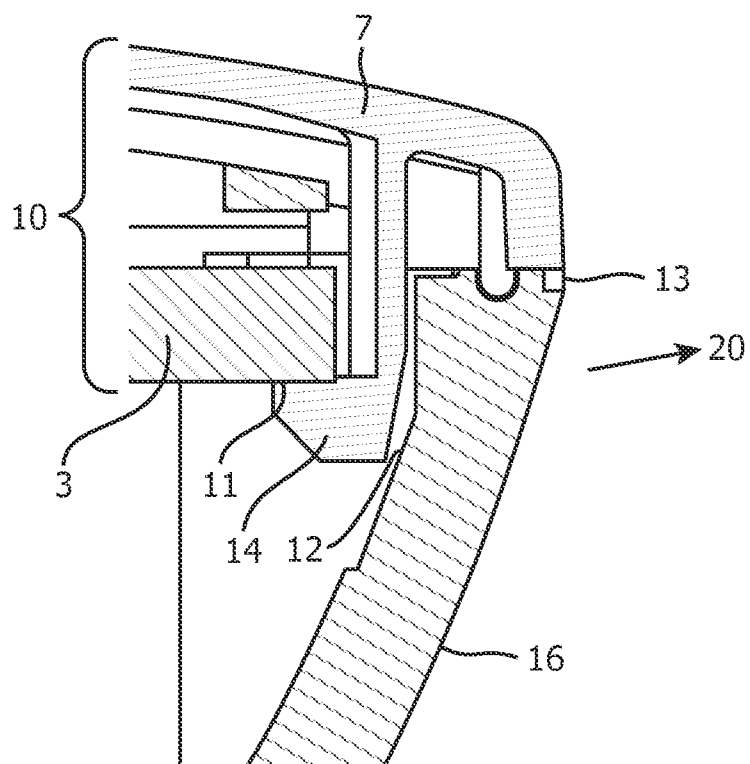


FIG. 4

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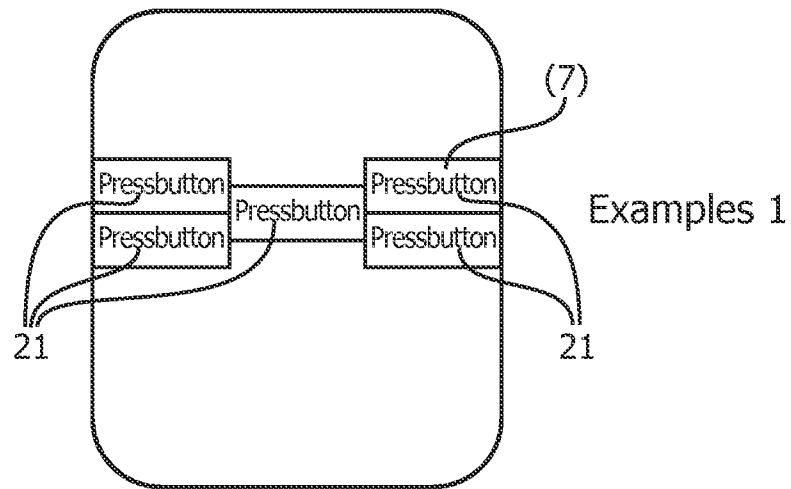


FIG. 5A

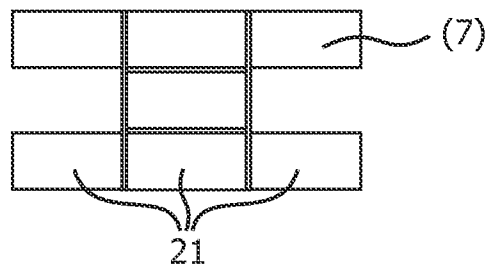


FIG. 5B

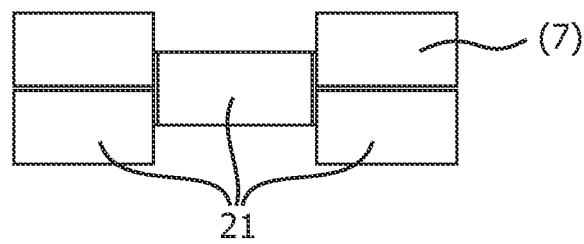


FIG. 5C

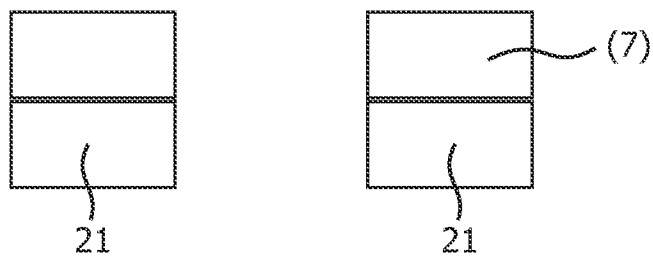


FIG. 5D

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2011/052988

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H01H13/705  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 851 618 A (AMINO FUMIHI RO [JP] ET AL) 25 July 1989 (1989-07-25)	1-8
Y	col umn 3, line 35 - col umn 6, line 11; f i g u r e s 1-6	9-11
Y	----- US 2004/031673 AI (LEVY DAVID H [US] ) 19 February 2004 (2004-02-19) paragraph [0097] - paragraph [0150] ; f i g u r e s 1-49	9-11
A	----- EP 1 876 620 AI (FM MARKETING GMBH [AT] ) 9 January 2008 (2008-01-09) paragraph [0016] - paragraph [0025] ; f i g u r e s 1-3	1
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Further documents are listed in the continuation of Box C.



See patent family annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance  
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.  
"&" document member of the same patent family

Date of the actual completion of the international search

30 September 2011

Date of mailing of the international search report

07/10/2011

Name and mailing address of the ISA/

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2011/052988

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4851618	A	25-07-1989	JP 6029857 Y2	10-08-1994
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